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Comparing Structural MRI Segementation Methods for a Brain Imaging Study of Tourette Syndrome

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The use of anatomical brain imaging data is important for the insight it provides into brain alterations present in neurodevelopmental disorders like Tourette syndrome (TS). These data include structural volumes and cortical thickness measures. However, it is difficult to obtain these measures accurately in an automated way, as there are a number of software packages for extracting anatomical measures that differ in approach and output. Therefore, the aim of this project is to compare several of these packages to evaluate accuracy. Our ultimate goal is to use these measurements to study the onset of tic disorders and identify predictive biomarkers of TS in children who first experience symptoms (i.e., motor and/or vocal tics). Structural T1-weighted MRI scans were used from 15 participants (ages 5–14 years old; 9 male, 6 female) with recently developed tics. The four segmentation software programs evaluated were FSL FIRST, Freesurfer (both unedited and manually edited segmentations), large deformation diffeomorphic metric mapping solution (LDDMMS), and an online brain volumetry tool called volBrain. We evaluated volumetric measures of structures in the basal ganglia and thalamus. Accuracy was determined by comparing outputs visually to an atlas, and comparing volume output data quantitatively across programs. Thus far, volBrain outputs and edited Freesurfer volume outputs have yielded the most similar and accurate results and both diverged significantly from volume outputs from FSL FIRST and LDDMMS. However, the ability to edit LDDMMS output on Freesurfer could result in more accurate outputs and will be tested. The results from this project will help determine which segmentation method yields the most accurate outputs to examine subcortical volumes in children with new-onset tics over time.